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# Notes on a Collection of Bermuda Deep-Sea Fishes<sup>1</sup>

MARION GREY

*Associate, Division of Fishes*

The fishes recorded in this paper were collected off Bermuda in July, August, and September, 1948, by an expedition conducted jointly by Chicago Natural History Museum and the Bermuda Biological Station. The collecting was done by means of the Woods Hole Oceanographic Institution's vessel, the *Caryn*.

Like all collections made in deep water, the present one contains many juvenile specimens. Most of these have been reserved for future study. Other unreported material consists of damaged specimens and a relatively large number of myctophids and leptocephali of dubious identity. The myctophids included were identified largely through use of the key published in 1949 by Fraser-Brunner (Proc. Zool. Soc. London, 118, pt. 4, pp. 1019-1106).

All information regarding stomach contents, internal parasites, and internal structures has been supplied by Dr. Lyell J. Thomas, of the University of Illinois, who examined the fresh specimens. The photographs were taken by Ronald J. Lambert, Staff Taxidermist, and the drawings were prepared by Margaret G. Bradbury, Staff Artist, Department of Zoology.

The list of hauls includes only those producing specimens, forty-two in all. Of these hauls, five were above 400 meters, twenty-one between 400 and 1000 meters, sixteen below 1000 meters.

In measurements the total length is given first, followed by the standard length in parentheses.

The following abbreviations are used in enumerating photophores: BR, branchiostegal photophores; IO, on isthmus; IP, from isthmus to pectoral fin; BO, between IO and ventral fins; PV, between pectoral fins and ventral fins; VO or VA, between ventral fins and anal fin; AC or AO, above anal fin; LO, lateral series.

<sup>1</sup>The Bermuda Biological Station, Contribution No. 172.

TABLE 1.—LIST OF CARYN STATIONS

Haul number	Date 1948	Time	N. Lat.	W. Long.	Depth of haul in meters	Meters of wire out	Depth to bottom in Meters	Gear
13	7/12	1035-1235	32° 07.2'	64° 57'	500-550	1500	2286	35-ft. otter trawl
14	7/12	1310-1600	32° 08.6'	64° 50.7'	730	1800	2378-2744	
15	7/14	2050-2300	32° 15.7'	64° 38.9'	260-275	1000	1280	
16	7/15	0055-0425	32° 11.7'	64° 44.5'	730-820	2000	2140	60-ft. otter trawl
17	7/15	0715-0950	32° 13'	64° 40.5'	730-820	2000	1920	
18	7/16	2155-2312	32° 19.2'	64° 35.6'	260-275	1000	....	
20	7/17	0550-0750	32° 08.2'	64° 38.8'	400-450	1500	2744	7-ft. ring net
22	7/20	2230-0435	32° 10.7'	64° 32.5'	730-820	2500	3200	
23	7/23	0050-0355	32° 05.5'	65° 20'	400-450	1500	4390	
24	7/23	1515-?	32° 05'	65° 20'	1000-1100	2500	4390	35-ft. otter trawl
25	7/23	2210-0030	32° 11'	65° 04'	400-450	1500	....	7-ft. ring net
26	7/24	0055-0325	32° 08'	65° 12'	590-660	2000	3840-3932	
27	7/27	1735-0030	32° 12'	64° 38.5'	1280-1370	3000	2286	



TABLE 1.—LIST OF CARYN STATIONS (*continued*)

Haul number	Date 1948	Time	N. Lat.	W. Long.	Depth of haul in meters	Meters of wire out	Depth to bottom in meters	Gear
28	7/28	0020-0740	31° 53'	64° 41.5'	1280-1370	3000	4000	35-ft. otter trawl
29	7/28	1935-0119	31° 55'	65° 00.7'	1000-1100	2500	3660	
30	7/29	0230-0725	32° 00'	64° 51.7'	1000-1100	2500	3660	
36	8/4	2155-0320	32° 13'	64° 34.5'	1000-1100	2500	2560	
37	8/5	0405-0838	32° 10'	64° 45'	730-820	2000	2195	
38	8/6	2245-0200	32° 13.5'	64° 32.5'	500-550	1500	2000-2560	7-ft. ring net
39	8/7	0335-0510	32° 10'	64° 38'	200	1000	2560	
41	8/12	2150-0045	32° 12.5'	64° 35.5'	500-550	1500	2560	
42	8/13	0200-0440	32° 10.3'	64° 43'	500-550	1500	2380	80-ft. otter trawl
44	8/14	0140-?	32° 09.5'	64° 45.2'	400-450	1500	3100-2370	
45	8/16	2205-0030	32° 14'	64° 35.5'	ca. 2000?	2000	2378	12-ft. ring net
46	8/17	0055-0420	32° 11.5'	64° 36'	730-820	2000	2560	
47	8/17	2114-0040	32° 15'	64° 35'	ca. 2000?	2500	2000	
48	8/18	0105-0340	32° 12.6'	64° 36.2'	500-550	1500	2378	
49	8/19	0925-1500	32° 14'	64° 35.5'	1500	3500	2470	

TABLE 1.—LIST OF CARYN STATIONS (*concluded*)

Haul number	Date 1948	Time	N. Lat.	W. Long.	Depth of haul in meters	Meters of wire out	Depth to bottom in meters	Gear
50	8/20	0927-1500	32° 08.2'	64° 33'	3100	3500	3100	7-ft. ring net
51	8/20	1005-1425	32° 11'	64° 32.8'	730-820	2500	2850	
52	8/23	0900-1454	32° 14.1'	64° 35.8'	1800?	3500	2000	
53	8/24	1940-2220	32° 12'	64° 35'	500-550	1500	2378	75-ft. otter trawl
54	8/24	2312-0445	32° 05.7'	64° 37.5'	1370-1460	3500	3290	
55	8/25	1850-2200	32° 12.7'	64° 35.2'	730-820	2000	2378	
56	8/25	2218-0223	32° 07'	64° 37'	260-275	1000	2744	12-ft. ring net
57	8/26	1926-2315	32° 13.3'	64° 37'	730-820	2000	1829	
58	8/26	2345-0330	32° 09'	64° 36'	260-275	1000	2650	
59	8/27	2000-0145	32° 15'	64° 36'	1370-1460	3500	2000	Blake trawl
60	8/28	0220-0433	32° 05'	64° 38'	500-550	1500	3270	
61	8/30	1135-?	32° 08'	64° 33'	ca. 3100	3500	3100	
62	9/2	0830-1215	32° 15.5'	64° 35'	1000-1100	2500	1830-2195	12-ft. ring net
63	9/2	1243-1630	32° 12'	64° 36'	1280-1370	3000	2378	

## Family SEARSIDAE

**Searsia koefoedi** Parr. Figure 45.

Hauls 30, 46; 2 specimens, 31 (28) and 70 (64) mm. Depth of hauls 730–1100 meters.



FIG. 45. *Searsia koefoedi* Parr. Haul 46.

*Remarks.*—The stomach of the larger specimen contained diatoms, algae, flagellates, and crustaceans.

## Family GONOSTOMATIDAE

**Bonapartia pedialota** Goode and Bean

Hauls 13–16, 23, 28–30, 37, 38, 44, 52, 56, 58, 59, 62; 35 specimens, 11 (9) to 75 (58) mm.

*Color.*—Fresh specimens opaque white with some dark pigment dorsally; snout translucent; cheeks and iris silvery blue; peritoneum silver; photophores pearly with light blue iridescence.

*Remarks.*—Although the material at hand is by no means adequate for a study of the vertical distribution of the species, there is some indication of nightly migration toward the surface, as well as a suggestion that post-larvae may remain in somewhat deeper water than older specimens. Of the seven post-larvae six were caught in depths of 1300–1450 meters and one in 700–800 meters, whereas only four of the metamorphosed individuals were caught deeper than 1300 meters. Night hauls yielded thirteen specimens from above and only three below 450 meters, while no specimens were caught above that depth during the day.

**Margrethia obtusirostra** Jespersen and Tåning. Figure 46.

*Margrethia obtusirostra* Jespersen and Tåning, 1919, Vidensk. Medd. Dansk Naturh. Foren., **70**: 222, pl. 17, figs. 11, 12.

*Margrethia disjuncta* Myers, 1934, Smiths. Misc. Coll., **91**, no. 9, p. 1.

Hauls 16, 30, 53, 57; 5 specimens, 50 (46), 55 (45) (2 specimens), 17 (13) and 11.5 (10) mm.

*Remarks.*—Three of these specimens, larger than any hitherto recorded, confirm Myers' suggestion that several of the characters separating *disjuncta* from *obtusirostra* change with growth. Other differences are apparently a matter of individual variation or the result of Myers' reliance upon the type figure, which is not detailed. The most significant difference between the two species, the disjunction of the last few BO photophores, is also apparently an adult character. In older Bermuda specimens the BO photophores are larger and closer together than in the type, which was only 19 mm. in standard length, and in position they have become even farther displaced upward than in *disjuncta*, the type of which was 31 mm. in standard length. Myers described the first nine photophores as being in a straight row, the tenth, eleventh, and twelfth in an ascending series, and the thirteenth and fourteenth below, on a level with the first nine. In the large Bermuda specimens the entire row ascends rather gradually with only the first five perhaps straight and the last two, as in *disjuncta*, on a level with the first five. Myers' statement that *obtusirostra* lacks a preorbital photophore is incorrect, for although the organ is scarcely evident in the figure of the type its presence is noted in the original description.

All five Bermuda specimens were captured in night hauls, the larger ones in depths between 730 and 1100 meters, the young in 500–550 and 730–820 meters.

**Gonostoma elongatum** Günther

Hauls 22, 25, 28, 30, 37, 49, 56; 9 specimens, 73 (63) to 250 (221.5) mm.

*Color.*—The largest specimen, a female from Haul 56, when fresh had a red spot on each side of the upper jaw, inside; the luminous scales on the caudal peduncle were also red.

*Remarks.*—Three of the specimens were taken at night in depths between 260 and 820 meters, six during the day in 730–1500 meters. Only twice were two specimens found in the same net.

A whole copepod and crustacean remains were found in the stomach of one specimen.

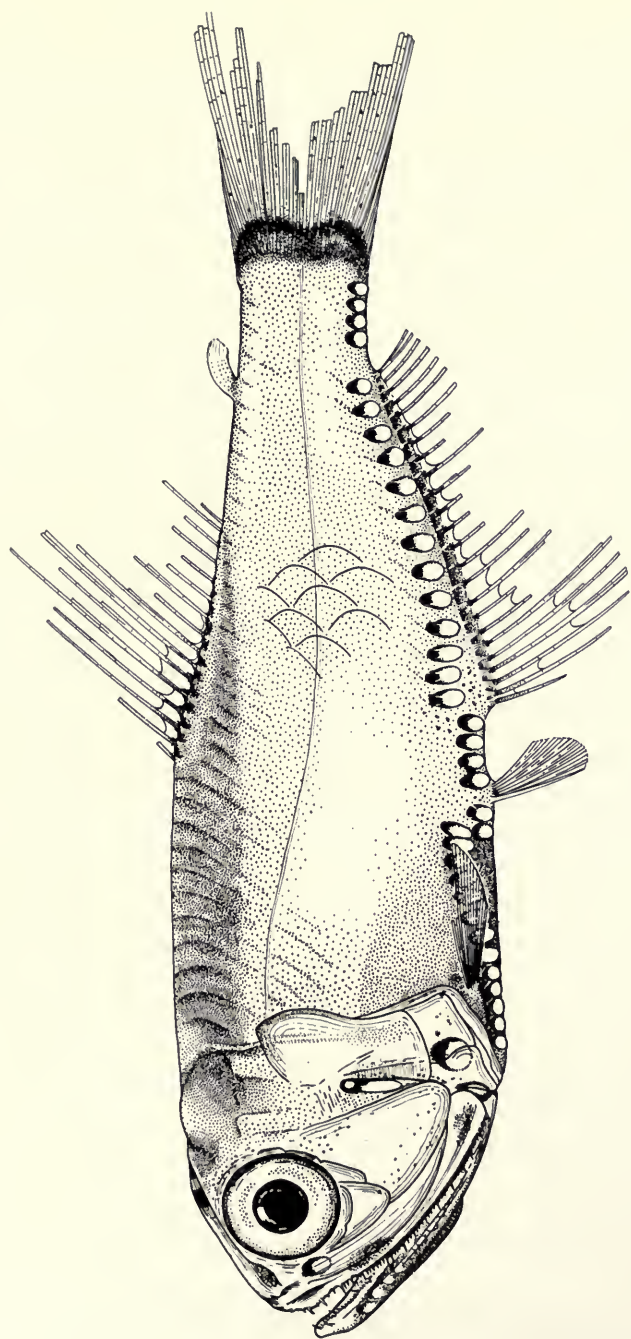


FIG. 46. *Margrethia obtusirostra* Jespersen and Tåning. Haul 30.

**Gonostoma bathyphilum** Vaillant

Haul 28; 1 specimen, 115 mm. standard length. Depth of capture 1280–1370 meters.

**Cyclothone braueri** Jespersen and Tåning

Hauls 13, 14, 16–18, 20, 22–24, 26–30, 36–38, 41, 44–53, 55–60, 62, 63; 1326 specimens, 12 (9.5) to 42 (36) mm.

*Remarks.*—In day hauls 444 specimens were taken in depths between about 400 and 2000 meters, at night 882 between 250 and 2000 meters. Although the species was caught during daytime hauls made above a depth of about 800 meters, it was taken in large numbers only below that depth, whereas at night it seemed to be more common above than below the 800-meter line.

**Cyclothone microdon** Günther

Hauls 15, 24, 26–30, 36–38, 41, 45–52, 55–60, 62, 63; 717 specimens, 16 (14) to 63 (54) mm.

*Remarks.*—Daytime hauls yielded 276 examples from depths of about 800 to 2000 meters. At night 441 specimens were taken at all depths between about 250 and 2000 meters. Large numbers were taken, even at night, only below 1000 meters.

**Cyclothone pallida** Brauer

Hauls 16, 22, 24, 27, 28, 30, 37, 41, 46, 48, 50, 51, 55–60, 62, 63; 138 specimens, 13 mm. standard length to 59 (53.5) mm.

*Remarks.*—By day 41 specimens were taken in depths between 800 and 2000 meters, at night 97 in depths of 260 to 1400 meters.

The collection contains also 685 damaged or juvenile specimens belonging either to this species or to *C. microdon*. Of these, 253 were taken in day hauls at depths between 800 and 2000 meters, mostly below 900 meters. Night hauls yielded 432 specimens from depths between about 250 and 2000 meters, but at night the fishes were more abundant above than below 900 meters, and were common as high as 275 meters.

**Yarrella blackfordi** Goode and Bean

Hauls 20, 22, 23, 25–27, 44, 56, 62; 13 specimens, 33 (28) to 57 (50) mm.

*Remarks.*—Of the thirteen specimens six were taken singly, two in a net on two occasions and three together on one occasion. Eleven



were caught at night in depths between 260 and 1370 meters, two during the day in 400 to 450 and in about 1000 meters.

### **Vinciguerria attenuata** Cocco

Hauls 15, 18, 20, 22-30, 36, 37, 41, 44, 46-48, 50-53, 55-60, 62, 63; 128 specimens, 14 (12.5) to 26.5 (22) mm.

*Remarks.*—By day 23 specimens were taken in depths from 400 to 2000 meters, at night 105 in 250 to 2000 meters, most of the latter in 250 to 800 meters.

There are in all twenty-two metamorphosing examples, most of them nearing adolescence. Their size, 13 to 15.5 mm. standard length, is slightly smaller than the range given for metamorphosing individuals of this species by Jespersen (1934, Faune Ichth. Atl. Nord, no. 15, 3 figs.). There are five post-larval specimens ranging in length between 14 (12.5) and 17 (15) mm.

### **Vinciguerria poweriae** Cocco

Hauls 15, 22, 28, 30, 36, 38, 48, 58; 11 specimens, 13 (12) to 41 (34) mm.

*Remarks.*—Two of the specimens were taken in day hauls at depths of about 1000 and 1280-1370 meters, nine at night in 260-1000 meters.

Three metamorphosing examples, all nearing adolescence, are 14 mm. in standard length, somewhat smaller than the size range reported by Jespersen (op. cit.).

### **Vinciguerria nimbraria** Jordan and Williams

Haul 47; 1 specimen, a post-larva 14.5 (12.5) mm. Depth of capture 2000? meters.

### **Ichthyococcus ovatus** Cocco

Hauls 20, 23, 26, 30, 37, 51; 7 specimens, 12 (10.5) to 42 (34) mm.

*Remarks.*—In view of the variations previously reported for this species, counts and measurements are given here for the largest specimen, from Haul 30.

D. 11; A. 15; P. 6; V. 7; L. l. ca. 36. Photophores: BR 11; IO 7+1; BO 17; VO 8; AO 13; LO 23.

Measurements in millimeters, followed in parentheses by measurements expressed in hundredths of standard length: standard

length 34, length of head 10 (29.5), greatest depth 10.3 (30.4), tip of snout to dorsal origin 15 (44.2), tip of snout to ventrals 20 (59.0), tip of snout to anal origin 25 (73.5), tip of snout to adipose dorsal 24 (70.5), diameter of eye 4 (11.8), length of snout 3 (8.85), base of dorsal fin 7 (20.6), base of anal ca. 5 (ca. 14.7), base of adipose dorsal ca. 4 (ca. 11.7), length of ventrals 4.5 (13.4), length of pectorals 8 (23.5).

Measurements in hundredths of length of head: diameter of eye 40.0, length of snout 30.0, base of dorsal 70.0, base of anal ca. 50.0, base of adipose ca. 40.0, length of ventrals 45.0, length of pectorals 80.0.

Depth of capture from 400 to 1100 meters; five specimens caught singly, two in one net.

### **Valenciennellus tripunctulatus** Esmark

Hauls 23, 28, 29, 52, 56, 58; 6 specimens, 16 (15) to 32 (28) mm.

*Color*.—Largest example, from Haul 52, nearly transparent when fresh, photophores on head purple. In alcohol, the two post-larvae are almost colorless, pigment present only in abdominal region internally and around the developing light organs on head and abdomen. Specimens 20 and 24 mm. standard length light brownish along back and upper sides, chromatophores visible but not obvious. The two largest specimens, 25 and 28 mm. standard length, pale dorsally and laterally with a row of black spots standing out in bold relief; abdomen, nape, and head below and behind eye black; snout and lower jaw transparent.

*Remarks*.—Taken singly, two post-larvae at night in depths from 260 to 275 meters, older specimens between 400 and 1100 meters at night, from 1280 to 1800 meters during the day.

## Family STERNOPTYCHIDAE

### **Argyropelecus hemigymnus** Cocco

Hauls 13, 20, 22, 24, 26–30, 36, 37, 41, 44, 46, 48, 50, 51, 53–55, 57, 58, 60, 62; 44 specimens, 8.5 (7) to 40 (34) mm.

*Remarks*.—Depth of capture by day 400–3000 meters, at night 260–1450 meters; only larger specimens, over 10 mm. standard length, taken above 700 meters at any time; one to eight specimens per net.



TABLE 2.—VERTICAL DISTRIBUTION OF STERNOPTYCHIDAE

Specimens less than 10 mm. long marked by asterisk; daytime captures in bold-faced type; night captures in light-faced type.

Meters	<i>Argyropelecus hemigymnus</i>	<i>Argyropelecus aculeatus</i>	<i>Argyropelecus amabilis</i>	<i>Sternoptyx diaphana</i>
250-350 . . . . .	2	5	...	...
350-450 . . . . .	{ 2 2	{ 4 4* 2*	3	1*
450-550 . . . . .	{ 7 1	...	...	{ 2 3*
550-650 . . . . .	2	1	...	...
700-800 . . . . .	{ 5 1* 1*	...	...	{ 8 1 4* 1*
800-900 . . . . .	8	3	...	{ 2 4 9*
1000-1100 . . . . .	{ 2 4 1*	1	...	{ 3 10 1*
Below 1300 . . . . .	{ 2 3 1*	3*	...	{ 2 3 1* 6*

### *Argyropelecus aculeatus* Cuvier and Valenciennes

Hauls 18, 20, 22, 23, 25, 26, 29, 44, 51, 56, 58; 23 specimens, 8 (7) to 90.5 (74) mm.

*Remarks.*—Our smallest specimens, from 7 to 8 mm. standard length, have the two abdominal spines characteristic of the species, the posterior one directed backward. With growth the anterior part of the body becomes deeper and the tail relatively shorter.

Youngest stages well pigmented on anterior portion of abdomen and head; otherwise pale, except for a dark vertical streak at back of head and two small black areas surrounding developing groups of photophores on tail.

At standard lengths from 8 to about 10 mm. pigment increased posteriorly and at 10 mm. only tail and upper anterior portion of back pale; photophores above anal fin and at base of caudal fin further developed.

Specimens 15 mm. standard length with black pigment extending on back to nearly below end of dorsal fin; sides becoming lightly

pigmented; black vertical bar forming above caudal photophores; the latter, as well as anal group, now well developed; transparent bony ridge on under side of caudal peduncle beginning to develop but not yet serrated.

Specimens 20 mm. standard length with black color on back extending to above group of anal photophores; bar above caudal group wider; silver pigment developing on sides of body; still no serrations on under side of caudal peduncle.

Specimens 25 mm. standard length with area on peduncle between the two groups of photophores still unpigmented but bar above caudal group wider; serrations now evident on under side of tail posteriorly; backwardly directed abdominal spine with a spur.

Specimen 32 mm. standard length still with a small unpigmented area on peduncle but this region beginning to darken dorsally and ventrally, leaving only the center pale; serrations on tail stronger; posterior abdominal spine provided with a spur on this specimen also.

Specimens 35 mm. standard length with pale area on peduncle still present, although somewhat lessened, more pigment above than below.

Specimen 36.5 mm. standard length with upper part of peduncle entirely pigmented but with a small pale area below, between the two groups of photophores on peduncle; even at 41 mm. a small pale spot present.

There is a gap in the series between the standard lengths of 41 and 74 mm., the latter specimen being a fully adult ripe female, apparently a larger specimen than any hitherto recorded. The adult is black at the posterior end of the peduncle, along the back, ventrally, and on the head, while the sides of the body and tail are silver.

All specimens longer than 10 mm. standard length were taken at night, in depths ranging between 250 and 1100 meters. Two young examples were caught during the day at a depth of 350–400 meters and three in 1800 meters. From one to four specimens per net were captured.

### ***Argyropelecus amabilis* Ogilby**

Hauls 23, 25; 3 specimens, 15.5 mm. standard length to 30 (25.5) mm. Depth of hauls 400–450 meters.

*Remarks.*—Development of pigment is apparently similar to the pattern found in *A. aculeatus*. There is, however, no evidence

of serrations on the ventral keels at a length of 25.5 mm. standard length.

### **Sternoptyx diaphana** Hermann

Hauls 16, 17, 22, 24, 27, 28, 30, 36–38, 41, 44, 45 or 46, 48, 51, 52, 55, 57, 60, 62, 63; 61 specimens, 7 (5.5) to 42 (32) mm.

*Remarks.*—Only six specimens were taken above a depth of 700 meters either by day or at night. From one to eleven specimens per net were taken.

The stomach of an example from Haul 52, length 13 (10) mm., contained crustacean remains.

## Family CHAULIODONTIDAE

### **Chauliodus sloanei** Bloch and Schneider

Hauls 13, 14, 17, 20, 22–24, 27, 29, 30, 36, 37, 41, 45–50, 52, 55, 56, 58–60, 62, 63; 75 specimens, 20 (17) to 259 (239) mm.

*Remarks.*—Thirty-two specimens were caught by day in depths between 400 and 3000 meters, and forty-three at night in 260–2000 meters, from one to eight specimens per net. No particular conclusions can be reached from an analysis of vertical occurrence, although the few metamorphosing individuals present in the collection were not taken with less than 2000 meters of wire out, the findings thus agreeing with those of Ege (1948, "Dana" Rep., 31: 113).

The stomach contents of specimens examined internally included fish remains, algae, eggs, and, in one example, an annelid worm.

### **Chauliodus danae** Regan and Trewavas

Hauls 13, 16, 22, 23, 26, 27, 37, 47–49, 53, 56–58, 60, 62; 35 specimens, 21 (19) to 114 (108) mm.

*Color.*—Freshly preserved specimens black with bronzy reflections on sides.

*Remarks.*—Six specimens were caught by day in depths from 500 to 1500 meters, and twenty-nine at night in 260–2000 meters, from one to nine specimens per net. No conclusions can be reached on vertical distribution with so few specimens at hand. Two of the few metamorphosing individuals were taken at about 275 meters below the surface.

A specimen measuring 107 (98) mm., from Haul 56, was a ripe female with about 250 mature eggs and some small undeveloped ones in the ovaries. The stomach contained small crustaceans.

### Family ASTRONESTHIDAE

#### **Astronesthes leucopogon** Regan and Trewavas

Haul 46; 1 specimen, 29 (24) mm. Depth of haul 730–820 meters.

#### **Neonesthes microcephalus** Norman. Figure 47.

Haul 55; 1 specimen, 136 (123) mm. Depth of haul 730–820 meters.



FIG. 47. *Neonesthes microcephalus* Norman. Haul 55.

#### **Neonesthes macrolychnus** Regan and Trewavas

Hauls 56, 58; 2 specimens, 68 (59) and 40 (37) mm. Depth of hauls 260–275 meters.

*Color.*—Postocular organ and barbel bulb pearly white in fresh specimens, yellow in preservative.

### Family STOMIATIDAE

#### **Stomias boa ferox** Reinhardt

Hauls 14–17, 22, 29, 36, 37, 45 or 46, 49, 53, 55, 58, 62; 18 specimens, 32.5 (29) to 65 (61) mm.

*Color.*—Two fresh specimens from Haul 29, standard lengths 58 and 54 mm., grayish above, abdomen black, barbel bulb with a spot of black proximally and containing a reddish inner body..

*Remarks.*—Seven specimens were taken by day in depths between 730 and 1500 meters, and eleven examples at night from depths ranging between 260 and 1100 meters. One or two per net were captured.

***Stomias brevibarbat* Ege**

Hauls 22, 49; 2 specimens, 103 (96) and ca. 17 mm. standard length. Depth of hauls 730–820 and 1500 meters.

*Color.*—Fresh, larger specimen quite black, post-orbital organ yellowish white, barbel whitish, fins transparent.

***Macrostomias longibarbat* Brauer. Figure 48.**

Haul 23; 1 specimen, 275 (262) mm.

*Color.*—Freshly preserved, bluish black above and below, chiefly pale on sides, owing probably to missing scales; sides show dark silvery reflections where scales remain; photophores purple with a bronze spot above each one.

*Remarks.*—Beebe (1933, *Zoologica*, 13, no. 8, p. 105, fig. 42) separated his species *M. calosoma* from *longibarbat* by the following characters: longer and more complicated barbel, greater depth, fewer V-A photophores, more numerous teeth, slightly larger eye, slightly longer snout, and a round, not elongate, cheek organ. His specimen measured 450 mm., considerably longer than other recorded specimens. Most, if not all, of the differences between the two species could be due to individual variation, growth changes, or sexual differences. Further material will be necessary to determine whether or not the two species are distinct. The present specimen is like Beebe's only in having fewer V-A photophores. Otherwise it agrees well with Brauer's description.

D. 14; A. 16; P. 6; V. 4. Photophores: ventral series, I-P 12, P-V 84, V-A 58, A-C 19; lateral series, P-V 84, V-A 56, 58.

Measurements in millimeters, followed in parentheses by measurements expressed in hundredths of standard length: length of head 18.5 (7.05), greatest depth 8 (3.05), barbel 130 (49.6), tip of snout to pectoral 18.5 (7.05), tip of snout to ventral fin 147 (55.7), diameter of eye 2.5 (0.95), length of snout 3.5 (1.32), interorbital width 2.5 (0.95), length of lower jaw 18 (6.89), length of upper jaw 16.5 (6.3), length of pectoral 13.5 (5.15), length of ventral 31 (11.8).

Measurements expressed in hundredths of length of head: greatest depth 43.2, diameter of eye 13.5, length of snout 18.9,



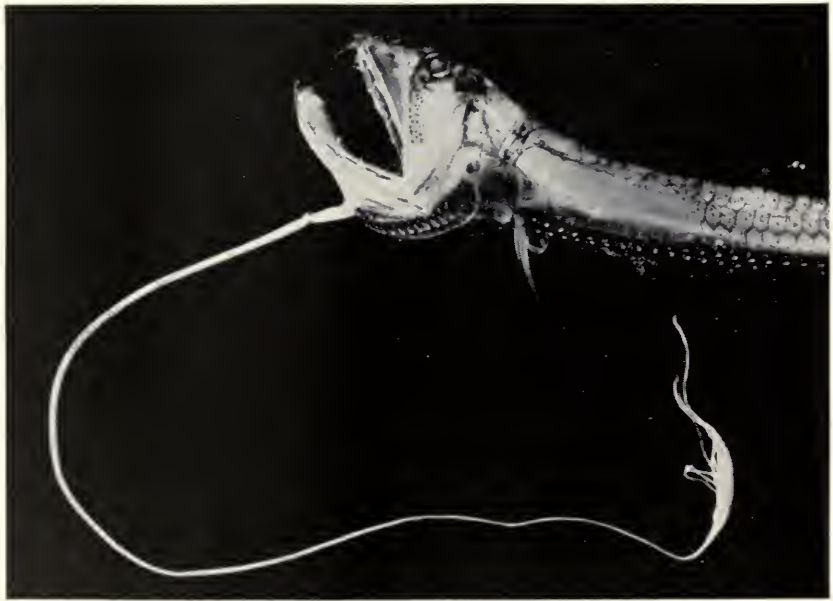
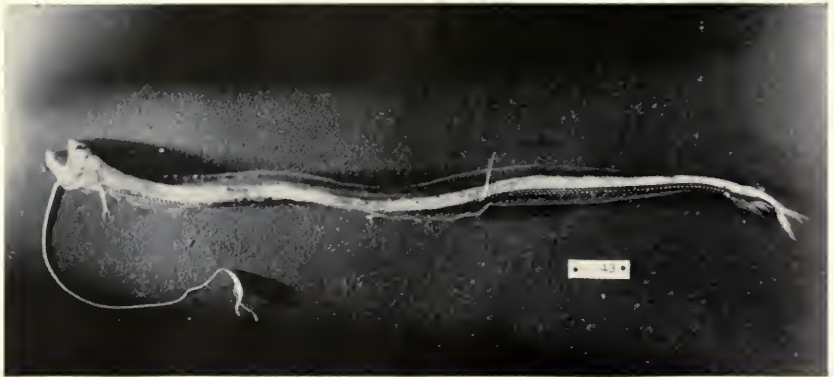


FIG. 48. *Macrostomias longibarbus* Brauer. Haul 23. Below, head and anterior portion of body.

interorbital width 13.5, length of lower jaw 97.0, length of upper jaw 89.0, length of pectoral 73.0.

Nostrils large and prominent, situated immediately in front of eye; membrane surrounding freshly preserved specimen jelly-like in consistency, after long preservation appearing as fin-folds preceding dorsal and anal fins.

The present specimen, described above, was taken at night at a depth of 400–450 meters. The only known specimen of *M. calosoma* Beebe was caught off Bermuda in 600 fathoms. The two types of *M. longibarbatus* were taken in the Indian Ocean off North Africa in 1213 meters and in the Gulf of Guinea at 1800 meters. Other records of *longibarbatus* are as follows: Norman (1930, Disc. Rep., 2: 315), one specimen, Gulf of Guinea, 850–950 meters; Murray and Hjort (1912, Depths Ocean, pp. 94, 612), from two stations in the eastern central Atlantic; Borodin (1931, Bull. Mus. Comp. Zool., 72: 65), two specimens, 41° 28' N. Lat., 43° 29' W. Long., 700–800 fathoms.

### Family MELANOSTOMIATIDAE

#### *Chirostomias pliopterus* Regan and Trewavas

Hauls 15, 18; 2 specimens, 125 (118) and 103 (96) mm. Depth of hauls 260–275 meters.

*Color*.—Freshly preserved specimens black generally with bronze iridescence laterally and some bluish-green iridescent spots above the upper row of photophores anteriorly; cheeks bronze; photophores silver; barbel jet black, bulb whitish, filaments yellow; vertical fins and ventrals dusky; pectoral rays black proximally, white or lemon yellow distally, swellings lemon yellow.

#### *Bathophilus metallicus* Welsh

Hauls 13, 14, 18, 22, 25, 59; 7 specimens, 29 (27) to 129 (122) mm.

*Color*.—Fresh specimens generally black, with bronze iridescence; postorbital yellow; barbel white; all fins colorless; photophores inconspicuous.

*Remarks*.—Two specimens were caught in day hauls made in depths of 500–730 meters, and five at night in 260–1460 meters.

#### *Echiostoma tanneri* Gill

Hauls 17, 41, 48; 3 specimens, 228 (213), 300 (276.5), and ca. 300 (279) mm.

*Color*.—The two larger specimens, fresh, both mature males, dull purplish black, on each side of back a longitudinal whitish speckled band that was not visible when the specimens were taken from the water; vertical bands on sides composed of small shiny black spots, a similar longitudinal band along sides below, between

the two rows of photophores. Fins red, especially the caudal; rays all brownish black basally, pale distally with some pigment spots; thickened prolonged pectoral ray shiny black. Teeth transparent, with opaque whitish material inside bases of some. Postorbital mauve or deep lavender-rose. Terminal threads of barbel red; this color and the red of the fins disappeared immediately when the specimens were placed in formalin. The smaller specimen, also fresh, an adolescent male, velvety bluish black in color. Fins as in larger examples but not so noticeably red. Postorbital lavender-blue anteriorly, silvery-white posteriorly. Barbel stem black basally, white just posterior to the bulbs, proximal bulb grayish brown, distal bulb pinkish, tendrils pinkish.

*Remarks.*—The smallest specimen was taken in a day haul at a depth of 730–820 meters; the two larger ones were captured at night in 500–550 meters.

**Eustomias bibulbosus** Parr

Haul 15; 1 specimen, 131 (125) mm. Depth of haul 260–275 meters.

**Eustomias obscurus** Vaillant

Haul 38; 1 specimen, 126 (120) mm. Depth of haul 500–550 meters.

*Color.*—When fresh, barbel stem translucent, inner core with a sprinkling of black pigment spots; bulb translucent with a slight yellowish tinge and a small reddish inner body.

**Eustomias bigelowi** Welsh. Figure 49.

Haul 39; 1 specimen, 102.5 mm. standard length. Depth of haul 200 meters.

*Color.*—After twenty-four hours in formalin, barbel bulb pea green. Specimen an adult male.

**Eustomias schmidtii** Regan and Trewavas

Haul 55; 1 specimen, 63 (60) mm. Depth of haul 730–820 meters.

**Photonectes dinema** Regan and Trewavas

Haul 28; 1 specimen, 41 (39) mm. Depth of haul 1280–1370 meters.





FIG. 49. *Eustomias bigelowi* Welsh. Haul 39.

### Family MALACOSTEIDAE

#### **Photostomias guernei** Collett

Hauls 16–18, 27, 37, 50, 52, 56, 58, 62, 63; 15 specimens, 49 (46) to 133 (124) mm.

*Color*.—In specimens freshly preserved in formalin, light organs on head and tendon connecting symphysis to hyoid arch white; teeth white except anterior pair of fangs in lower jaw, which are black basally, white distally. Before preservation the postorbital was pink or reddish.

*Remarks*.—Eight specimens were taken by day in depths from 730 to 3000 meters, and seven at night at depths between 260 and 1370 meters (five of these in 260–275 meters), one or two specimens per net.

The largest example, from Haul 26, was a mature male with active spermatozoa. In the body cavity, above the stomach, was a highly vascular sac, in which appeared to be numerous ova in various stages of cleavage. The stomach contained fish bones.

### Family IDIACANTHIDAE

#### **Idiacanthus fasciola** Peters

Hauls 41, 56, 58, 62; 4 specimens, 140 (135) to 190 (184) mm.

*Remarks*.—One specimen was taken in a day haul, ca. 1000 meters, and three were taken at night in 260–550 meters.

## Family WINTERIIDAE

**Rhynchohyalus natalensis** Gilchrist and von Bonde

*Hyalorhynchus natalensis* Gilchrist and von Bonde, 1924, Rep. Fish. Mar. Biol. Survey So. Afr., 3, no. 7, p. 4, pl. 1, fig. 1.

*Rhynchohyalus natalensis* Barnard, 1925, Ann. So. Afr. Mus., 21: 130; Smith, 1949, Sea Fishes So. Afr., p. 97; Grey, 1952, Copeia, 1952: 88; Hubbs, 1953, Copeia, 1953: 96.

*Ophthalmopelton macropus* Maul, 1946, Bol. Mus. Mun. Funchal, 2, no. 3, p. 62, fig. 23; Grey, 1952, Copeia, 1952: 88, fig. 1.

Haul 13 or 14; 1 specimen, 112 (94) mm. Depth of haul 500–550 or 730 meters.

This specimen has been previously recorded and described.

## Family BATHYLAGIDAE

**Bathylagus glacialis** Regan

Haul 22; 1 specimen, 43.5 (40) mm. Depth of haul 730–820 meters.

## Family SCOPELARCHIDAE

**Scopelarchus anale** Brauer

Hauls 27, 55; 2 specimens, 38 (31) and 48 (39) mm. Depth of hauls 1280–1370 and 730–820 meters.

*Color*.—In freshly preserved specimen head and body white, the black peritoneum showing through anteriorly; eye black, pupil white; some black pigment on top of head; faint duskiness along back and on dorsal fin; pectoral black.

## Family EVERMANNELLIDAE

**Evermannella atrata atlantica** Parr

Hauls 52, 62; 2 specimens, 22.5 (19.5) and 34 (30) mm. Depth of hauls 1800? and 1000–1100 meters.

**Evermannella balbo** Risso

Haul 25; 2 specimens, 33.5 (31) and 36 (33.5) mm. Depth of haul 400–450 meters.

**Evermannella indica melanoderma** Parr. Figure 50.

Hauls 46, 56, 57; 3 specimens, 80 (72.5), 90 (79), and 85 (74) mm. Depth of hauls 260–820 meters.

*Color*.—In fresh specimens body color gray owing to a heavy sprinkling of black pigment on light background; belly and caudal

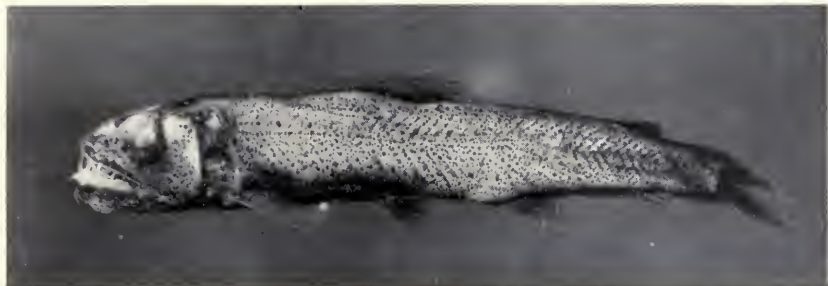


FIG. 50. *Evermannella indica melanoderma* Parr. Haul 56.

peduncle darker; fins dusky, caudal and adipose darker; bases of vertical fins black; sides iridescent; eyes pale green above, silver on sides, bluish-purple reflections on lower portion; lower jaw and upper jaw posteriorly white with black pigment dots; greenish iridescence below eye, on lower posterior part of opercle and on posterior half of lower jaw.

*Remarks*.—The stomach contents of two specimens included remains of myctophids.

**Family MYCTOPHIDAE****Hygophum benoiti** Cocco

Hauls 16, 22, 26–28, 30, 37, 38, 41, 44, 45, 48, 50, 58, 59, 62; 111 specimens, 11 (10) to 28 (23.5) mm.

*Remarks*.—All specimens young, taken principally in night hauls, only once (four examples) above a depth of 400–450 meters; from one to twenty-four were taken per net.

**Hygophum reinhardtii** Lütken

Hauls 50, 55; 2 specimens, ca. 11 mm. standard length and 28 (23) mm. Depth of hauls 3100 and 730–820 meters.

**Hygophum macrochir** Günther

Haul 37; 1 specimen, 34.5 (31) mm. Depth of haul 730–820 meters.

**Hygophum hygomi** Lütken

Hauls 14, 22, 29, 30, 37, 58; 6 specimens, 20 (18.5) to 63.5 (52.5) mm.

*Remarks.*—One specimen taken at night in 260–275 meters, the others in 730–1100 meters in both day and night hauls.

**Diogenichthys atlanticus** Tåning

Hauls 16, 17, 22–30, 36, 37, 41, 44–49, 51, 55–60, 62, 63; 163 specimens, 11.5 (9) to 22 (19.5) mm.

*Remarks.*—An abundant species, taken only at or below 700–800 meters by day and infrequently above that depth even at night. From one to twenty-two specimens were taken per haul. The specimens include adults of both sexes as well as metamorphosing individuals and post-larvae.

**Gonichthys cocco** Cocco

Hauls 22, 26, 27, 37, 48, 57, 59; 9 specimens, 19 (15.5) to 30 (26) mm.

*Remarks.*—Caught once in a day haul, 730–820 meters, otherwise at night in 500–1460 meters.

**Centrobranchus nigro-ocellatum** Günther

Hauls 44, 60; 2 specimens, 17 (15) and 15 (13.5) mm. Depth of hauls 400–550 meters.

**Diaphus dofleini** Zugmayer

Hauls 13, 16, 18, 20, 22–30, 36, 37, 39, 52, 56, 58; 72 specimens, 15.5 (13) to 41 (37) mm.

*Color.*—In fresh specimens cheeks iridescent silvery blue, eyes red. Area above anal fin pinkish. Photophores violet blue. Liver pink.

*Remarks.*—Only five specimens were taken in hauls made above a depth of 400 meters and these at night. From one to thirty-six per net were taken.

In one specimen from Haul 52 the stomach and intestine held remains of copepods.

**Diaphus gemellari** Cocco

Hauls 14, 16; 2 specimens, 36.5 (31) mm. Depth of hauls 730–820 meters.

**Diaphus metopoclampus** Cocco. Figure 51.

Hauls 16, 22, 48; 3 specimens, 83.5 (70.5), 89 (76), and 83 (73) mm. Depth of hauls 500–820 meters.



FIG. 51. *Diaphus metopoclampus* Cocco. Haul 16.

*Color*.—In fresh specimens body black or brownish black with metallic bluish iridescence. Fins dusky. Eye silver, iris golden. Large light organs on head pearly white. Body photophores brilliant metallic blue. Suprapectoral luminous patch whitish.

*Remarks*.—The luminous organs on the head of the specimen from Haul 16 were aglow when it was brought aboard and they continued to luminesce when the fish was placed in sea water.

Dr. Lyell J. Thomas found the specimen from Haul 48 to be a ripe female with some of the eggs in cleavage. A few of these eggs were kept at a temperature of 8–10° C. for five days, during which time they continued their development. Crustacean remains were found in the stomach.

**Diaphus fulgens** Brauer

Hauls 22, 58; 3 specimens, 14.5 (12) to 18.5 (15.5) mm. Depth of hauls 730–820 and 260–275 meters.

**Notolychnus valdiviae** Brauer

Hauls 18, 20, 22, 23, 25–27, 30, 41, 46, 48, 49, 55–57, 60, 63; 42 specimens, 10 (8.5) to 25 (22) mm.

*Remarks.*—Caught principally between 400 and 800 meters. From one to six per net.

**Lampadena minima** Tåning

Haul 30; 1 specimen, 40 (33) mm. Depth of haul 1000–1100 meters.

*Color.*—In fresh specimen body intense black except where scales have been lost. Infracaudal luminous plate brilliant pearly white.

**Lampadena bathyphila** Tåning

Hauls 36, 49, 57, 59; 5 specimens, 42 (38.5) to 65 (59) mm. Depth of hauls 730–820 and 1000–1500 meters.

**Lampadena chavesi** Collett

Haul 41; 1 specimen, 24.5 (21.5) mm. Depth of haul 500–550 meters.

**Lampanyctus ater** Tåning

Hauls 15, 24, 28, 38, 45, 46, 55, 59, 62; 12 specimens, 44.5 (38.5) to 105.5 (94) mm.

*Remarks.*—Taken in three day hauls made between 1000 and 1370 meters and in six night hauls, once in 260–275 meters, otherwise below 500 meters. From one to two specimens per net were taken.

**Lampanyctus cuprarius** Tåning

Hauls 15–18, 22–25, 28–30, 36, 37, 41, 45–48, 51, 55–59, 62, 63; 69 specimens, 45 (38) to 82 (72.5) mm.

*Remarks.*—Caught above a depth of 400 meters in only four night hauls. From one to seven specimens per net were taken.

Three of the specimens are females with ripe eggs. In one of these examples spermatozoa were present in the reproductive system and some of the comparatively small number of eggs showed development. A male from the same haul contained active spermatozoa.

The stomachs of four specimens examined contained remains of flagellates, crustaceans, and fish vertebrae.



**Lampanyctus taaningi** Parr

Haul 45; 1 specimen, 33.5 (29) mm. Depth of haul 2000? meters.

**Lampanyctus pusillus** Johnson

Hauls 16-18, 20, 22-27, 30, 36-39, 41, 45, 46, 48-52, 55-60, 62, 63; 124 specimens, 16 (12.5) to 41 (36) mm.

*Remarks.*—Most of the specimens were caught at depths below 400 meters but some were taken in four of the five hauls made above that depth. From one to fifteen specimens per net were taken.

**Lampanyctus alatus** Goode and Bean

Haul 62; 1 specimen, 59.5 (50) mm. Depth of haul 1000-1100 meters.

**Lampanyctus supralateralis** Parr

Hauls 41, 48, 55; 3 specimens, ca. 15 mm. standard length to 51.5 (45) mm. Depth of hauls 500-820 meters.

**Lampanyctus photothorax** Parr

Hauls 16, 22, 23, 25, 27, 29, 30, 37, 38, 41, 45-47, 56-59, 62, 63; 60 specimens, 12.5 (11) to 59 (49) mm.

*Remarks.*—Caught only twice above a depth of 400 meters, at night. From one to nine specimens per net were taken.

**Family EURYPHARYNGIDAE****Eurypharynx pelecanoides** Vaillant

Hauls 49, 52, 55, 59, 62, 63; 10 specimens, 142-540 mm. total length.

*Remarks.*—One specimen was caught at a depth of 730-820 meters, others between 1000 and 1500-1800 meters. From one to four specimens per net were taken.

An example from Haul 49, length 456 mm., and one from Haul 63, 540 mm., were males in breeding condition. A few remains of fishes and crustaceans were found in the digestive tracts.

The structure at the tip of the tail was red or pink in fresh specimens.

**Leptocephalus pseudolatissimus** Bertin

Haul 30; 1 specimen, 30 mm. total length. Depth of haul 1000–1100 meters.

**Family not Determined****Leptocephalus splendens** Lea

*Leptocephalus splendens* Lea, 1913, Rep. Sci. Res. M. Sars No. Atl. Deep-sea Exp., 1910, 3, no. 1, p. 29, pl. 4, fig. 2, text fig. 19.

*Leptocephalus* sp. Murray and Hjort, 1912, Depths Ocean, p. 86, fig. 66.

*Leptocephalus* sp. (*Coll. Monaco E*) Roule, 1914, Bull. Inst. Océanogr. Monaco, 292: 7; 1919, Rés. Camp. Sci. Monaco, 52: 104, pl. 7, figs. 5, 5b.

*Leptocephalus roulei* d'Ancona, 1928, Mem. R. Com. Talass. Ital., 146: 113.

*Leptocephalus splendens* d'Ancona, 1928, Mem. R. Com. Talass. Ital., 146: 116.

Hauls 25, 41; 2 specimens, 78 and 86.5 mm. total length. Depth of hauls 400–550 meters.

*Remarks.*—The following table indicates that the four known specimens belong to a single species.

Author	Total length mm.	Depth mm.	Snout to vent mm.	Head mm.	Eye mm.	Myomeres
Lea (1913)	56	8 (14.3%)	...	...	...	81 + 54 = 135
<i>Caryn</i> ... (Haul 25)	78	10 (12.8%)	...	4.5 (5.8%)	...	77 + 52 = 129
<i>Caryn</i> ... (Haul 41)	86.5	11 (12.7%)	62 (71.6%)	5.5 (6.3%)	2.1	76 + 56 = 132
Roule ... (1914, 1919)	117	17 (14.5%)	83 (71.0%)	6.5 (5.5%)	2.5	75 + 50 = 125

The “telescopic” eye described and figured by Roule (1919, Rés. Camp. Sci. Monaco, 52, pl. 7, fig. 5, *a*) apparently develops with growth. The eye is not “telescopic” in our larger specimen but it is more prominent than in the smaller one, or in Lea’s specimen (1913, Rep. Sci. Res. M. Sars No. Atl. Deep-sea Exp., 3, no. 1, fig. 19). It encroaches upon the upper profile of the head and is very like the eye as figured by Roule. In form and pigmentation all examples appear to be identical.

**Family DERICHTHYIDAE****Derichthys serpentinus** Gill

Hauls 29, 62; 2 specimens, 241.5 (ripe female) and 205 mm. total length. Depth of hauls 1000–1100 meters.



## Family NESSORHAMPHIDAE

**Nessorhamphus ingolfianus** Schmidt

Haul 22; 1 specimen, 156 mm. total length. Depth of haul 730–820 meters.

## Family SERRIVOMERIDAE

**Serrivomer beani** Gill and Ryder

Hauls 55, 57; 3 specimens, 158, 159, and 220 mm. total length. Depth of hauls 730–820 meters.

**Serrivomer brevidentatus** Roule and Bertin

Haul 62; 1 specimen, 475.5 mm. total length. Depth of haul 1000–1100 meters.

## Family NEMICHTHYIDAE

**Nemichthys scolopaceus** Richardson

Haul 37; 1 specimen, ca. 200 mm. total length. Depth of haul 730–820 meters.

*Remarks.*—The collection contains several larval and metamorphosing specimens identifiable with this species according to current synonymies. However, the developmental stages of closely related species are still unknown and it seems unwise to assign all of these juveniles to *Nemichthys*.

## Family CYEMIDAE

**Cyema atrum** Günther

Hauls 46, 63; 3 specimens, total lengths 39, 37, and 111 mm.

*Remarks.*—The two smaller specimens are larvae, one from each haul. Depth of hauls 730–820 and 1280–1370 meters. The adult example was from the latter depth.

## Family GADIDAE

**Melanonus unipennis** Beebe

Haul 22; 1 specimen, 84 (75) mm. Depth of haul 730–820 meters.

*Color*.—Fresh specimen brownish black, head darker, fins all dusky.

### Family DIRETMIDAE

***Diretmus argenteus* Johnson. Figure 52.**

Haul 62; 1 specimen, 38 (34) mm. Depth of haul 1000–1100 meters.



FIG. 52. *Diretmus argenteus* Johnson. Haul 62.

### Family ANOPLOGASTRIDAE

***Anoplogaster cornuta* Valenciennes. Figure 53.**

*Hoplostethus cornutus* Valenciennes in Cuvier and Valenciennes, 1833, Hist. Nat. Poiss., 9: 470—western Atlantic, ca. 26° S.

*Anoplogaster cornutus* Günther, 1859, Cat. Fish. Brit. Mus., 1: 12; 1887, Rep. Sci. Res. Voy. Challenger, Zool., 22: 25; Lütken, 1878, K. Danske Vidensk. Selsk. Forhandl., 1877: 181, pl. 5, figs. 4–7; Goode and Bean, 1895, Ocean. Ichthyol., pp. 184, 185, fig. 203; Jordan and Evermann, 1896, Bull. U. S. Nat. Mus., 47: 840; Borodin, 1931, Bull. Mus. Comp. Zool., 72: 81; Parr, 1933, Bull. Bingham Oceanogr. Coll., 3, (6), p. 10, fig. 5; Roule, 1935, Bull. Inst. Océanogr. Monaco, 674: 5; Beebe, 1937, Zoologica, 22: 206; Yabuta, 1953, Contr. Nankai Reg. Fish. Res. Lab., 1, (15), p. 2; Maul, 1954, Bol. Mus. Mun. Funchal, 7, (17), p. 30, figs. 10, 11.

*Caulolepis longidens* Gill, 1883, Proc. U. S. Nat. Mus., 6: 258; Günther, 1887, Rep. Sci. Res. Voy. Challenger, Zool., 22: 26; Goode and Bean,

1895, *Ocean. Ichthyol.*, p. 185, fig. 204; Jordan and Evermann, 1896, *Bull. U. S. Nat. Mus.*, **47**: 839; Gilbert, 1898, *Proc. U. S. Nat. Mus.*, **21**: 565; 1905, *Bull. U. S. Fish Comm.*, **1903**: 616; Bean, 1898, *Proc. U. S. Nat. Mus.*, **21**: 639; Brauer, 1906, *Wiss. Ergebn. Deutschen Tiefsee Exp. Valdivia*, **15**, (1), p. 286, pl. 12, fig. 4; Zugmayer, 1911, *Rés. Camp. Sci. Monaco*, **35**: 102, pl. 5, fig. 3; Roule and Angel, 1933, *Rés. Camp. Sci. Monaco*, **86**: 83; Osório, 1917, *Arch. Univ. Lisboa*, **4** (not seen); Norman, 1930, *Disc. Rep.*, **2**: 347; Borodin, 1931, *Bull. Mus. Comp. Zool.*, **72**: 81; Parr, 1933, *Bull. Bingham Oceanogr. Coll.*, **3**, (6), p. 10; de Buen, 1936, *Not. Res. Inst. Esp. Oceanogr.*, (2), **94**: 156; Fowler, 1936, *Bull. Amer. Mus. Nat. Hist.*, **70**: 1267, fig. 543; Beebe, 1937, *Zoologica*, **22**: 206; Schroeder, 1940, *Copeia*, **1940**: 237; Maul, 1954, *Bol. Mus. Mun. Funchal*, **7**, (17), p. 35, fig. 12.

*Caulolepis subulidens* Garman, 1899, *Mem. Mus. Comp. Zool.*, **24**: 60, 360, pls. B, 12, 72, fig. 1.

Hauls 29, 37, 49, 61; 4 specimens, ?, 21 (19), 26.5 (21.5), and 160 mm. standard length.

*Color*.—Adult, fresh specimen uniform blackish brown, buccal cavity black, iris blue. Young specimens silvery before preservation; after twenty-four hours in formalin, body uniform light blue-gray fading to colorless on caudal peduncle; head and fins colorless; on flattened abdomen a patch of black pigment starting at isthmus as a narrow strip that widens posteriorly and ends below ventral bases; a narrow black bar crossing abdomen about halfway between ventral bases and vent; abdomen of 26.5 (21.5) mm. specimen sprinkled elsewhere with black dots.

*Remarks*.—Dr. E. Bertelsen (1953, in litt.) has written that material collected by the *Dana* during her several voyages shows *Anoplogaster cornuta* to be the young of *Caulolepis longidens*, and the identity of the two forms is clearly seen in an examination of the four specimens taken by the *Caryn* and the following examples of intermediate size from the collection of Chicago Natural History Museum:

One specimen, standard length 90 mm., *Oregon* Station no. 796, 29° 10' N., 87° 55' W., Gulf of Mexico, June 12, 1953, 40-ft. otter trawl, depth 900–1100 meters.

Four specimens, standard lengths 81, 78, 77, and 76 mm. Madeira.

The two largest examples seen, 160 and 90 mm. standard length, are typical *Caulolepis*; the others would be identified with *Anoplogaster*. Changes occurring with growth account for the differences hitherto separating the two forms, as follows:

(1) The body is triangular in cross section in very young specimens such as the three taken by the *Caryn* off Bermuda and becomes

evenly compressed with growth as seen in the Madeiran specimens and the two adult examples. The tail is compressed at all ages, resulting in a somewhat misplaced anal fin in the small specimens with flattened bellies—the “essential skewness” described by Parr (1933).

(2) In descriptions of young specimens the scales have been said to be absent or reduced, or the skin covered with rough tubercles. Actually the tubercles are incipient scales. Dr. Edward M. Nelson, of Stritch School of Medicine, Loyola University, has carefully examined the scales of most of the specimens recorded here and finds them to be identical in structure, although in different stages of development.

(3) The series at hand and various published figures show immediately that the long cephalic and preopercular spines are typical of young examples. In adults these spines are short and stubby.

(4) In the young there is a single row of small uniform teeth in both jaws. As growth proceeds, a few slightly larger teeth appear until eventually the characteristic fangs develop. These fangs are depressible in the young Madeiran examples, fixed in the two adults. Most of the small teeth disappear in time but in the largest example at hand a few are still present on the posterior portion of the upper jaw, behind all of the larger teeth; and in the 90 mm. adult from the Gulf of Mexico a few small teeth are also present in the upper jaw between the fangs, as well as in the posterior portion of both upper and lower jaws. All four Madeiran examples have a single row of small uniform teeth with the anterior fangs developed, but very short, in both jaws.

(5) The most distinguishing feature separating adult from young, besides the enormous fangs, is a difference in color. Typical *Caulolepis* are uniform brownish black, typical *Anoplogaster* largely bluish gray with a few distinctive black markings ventrally. The two larger Madeiran specimens are darker generally than the other young examined. Minute black pigment spots are visible in the skin of all the young but these are more concentrated in the larger ones.

Bertelsen (1953, in litt.) wrote that the *Dana*, at Station 3997, north of St. Helena, with 600 meters of wire out, took, in the same haul, two specimens, one a typical adult, color brownish black, its standard length 76 mm., and another 72 mm. standard length, its color a lighter brown than the first specimen but not as light as that





FIG. 53. *Anoplogaster cornuta* Valenciennes. Adult, above; haul 61. Young, below; haul 49.

of a typical *Anoplogaster*. The fangs of both of these fishes, while developed, are relatively short and all depressible. These two specimens, which I have not seen, help to complete the growth picture.

Of the numerous specimens, mostly young stages, reported by Maul (1954) from Madeira, the largest juvenile was 88 mm., the smallest adult stage 83 mm. in standard length. Reports thus indicate that the black color of the adult is developed between the

standard lengths of 76 and 90 mm., while the compressed body form is acquired earlier and the characteristic dentition later. None of the specimens referred by Maul to *A. cornuta* were sexually mature.

Dr. Nelson, who has been making a study of the air-bladder structure of berycoid fishes, found a very small air-bladder present in the small Bermuda specimen from *Caryn* Haul 37 but none at all in the adult from Haul 61, nor in two of the Madeiran examples.

*A. cornuta* reaches a standard length of at least 160 mm. It is apparently a bathypelagic species. It is known from numerous specimens reported from both sides of the Atlantic Ocean from about 44° N. to about 46° S. and, in the Pacific, from the Gulf of Panama, off southern California, Hawaii, and the Bonin Islands. Young stages have been caught between 45 and 3084 meters, adults in 900–4900 meters. According to Maul (1954) *A. cornuta* is at certain times of the year very common at Madeira in about 50 to 100 fathoms, while the adult (*Caulolepis*) apparently lives in considerably deeper water.

The young specimen from *Caryn* Haul 29 is incomplete, measuring 5 mm. to the end of the dorsal fin, beyond which the body is missing. The adult, from Haul 61, is a female with proportionately large ovaries containing numerous small eggs in various stages of development. The fish lived for five hours in a dish of iced sea water that was too shallow to permit an upright position. When transferred to deeper but somewhat warmer water, it died immediately.

### Family MELAMPHAIDAE

#### **Melamphaes microps** Günther

Hauls 16, 22, 23, 28–30, 36–39, 41, 44, 47, 51, 56, 60, 62, 63; 41 specimens, 9.5 mm. standard length to 30 (25.5) mm.

*Remarks.*—Taken in day hauls between 730 and 1370 meters, at night in 200–2000? meters, but chiefly above 1000 meters.

#### **Melamphaes opisthopterus** Parr

Hauls 30, 36, 38, 45, 46, 48, 55, 57, 59, 62, 63; 17 specimens, 16 (14) to 39.5 mm. standard length.

*Remarks.*—Caught in 1000–1370 meters by day, 500–2000? meters at night.

**Melamphaes robustus** Günther

Hauls 15, 18, 22, 25, 26, 30, 50, 52; 17 specimens, 15 (12) to 32 (27.5) mm.

*Remarks.*—Three of the hauls were made during the day at depths between 1000 and 3500 meters, others at night from 400 to 1000 meters.

**Melamphaes mizolepis** Günther

Hauls 24, 38, 63; 6 specimens, 35.5 (29) to 62.5 (52.5) mm. Depth of hauls 500–1370 meters.



FIG. 54. *Melamphaes anthrax* Osório. Haul 36.

**Melamphaes anthrax** Osório. Figure 54.

Hauls 18, 36, 37; 3 specimens, 42 (36.5), 52 (45), and 65 (54) mm. Depth of hauls 260–1100 meters.

*Remarks.*—These specimens have been recorded (Copeia, in press).

Family **CHIASMODONTIDAE****Chiasmodon niger pluriradiatus** Parr

Haul 50; 1 specimen, 145 (122) mm. Depth of haul 3100 meters.

*Remarks.*—The stomach contained pieces of glass-sponge, possibly swallowed in the net, which reached bottom.

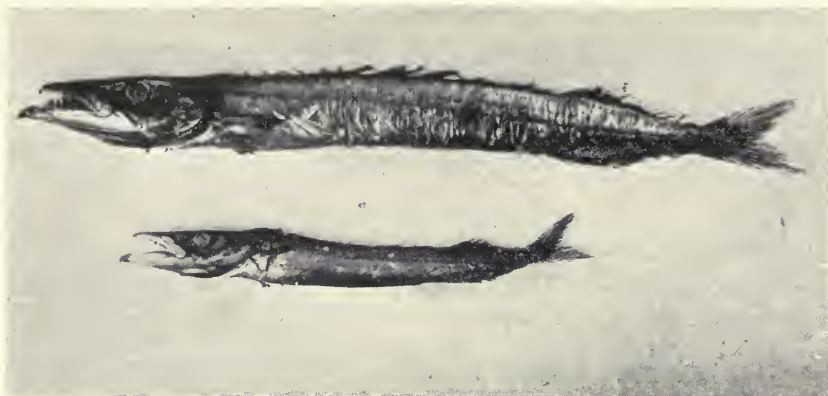


FIG. 55. *Nesiarchus nasutus* Johnson. Haul 22.

### Family GEMPYLIDAE

#### *Nesiarchus nasutus* Johnson. Figure 55.

*Nesiarchus nasutus* Coelho, 1942, Trav. Stat. Biol. Marit. Lisbonne, 46: 53; Grey, 1953, Copeia, 1953: 135 (full synonymy); Lozano Rey, 1953, Mem. R. Acad. Cien. Madrid, Ser. Cien. Nat., 14: 546, pl. 42, fig. 4; Brandes, Kotthaus and Krefft, 1954, Ann. Biol. Cons. Perm. Int. Explor. Mer, 9: 47-48; Voss, 1954, Bull. Mar. Sci. Gulf Caribbean, 4, (2), p. 124; Rost, 1954, Tromsø Mus., Astarte, 7: 1.

Hauls 22, 48, 57, 60; 6 specimens, 326 (287) to 830 (737) mm. Depth of hauls 500-550 and 730-820 meters.

### Family TRICHIURIDAE

#### *Benthodesmus simonyi* Steindachner

*Benthodesmus simonyi* Tucker, 1953, Proc. Zool. Soc. London, 123: 180, pl. 2, fig. 4 and pl. 3, fig. 6 (full synonymy).

Haul 20; 1 specimen, 228 (221) mm. Depth of haul 400-450 meters.

*Color*.—In fresh specimen body and most of head uniform silvery; snout dusky, black at tip; mandible black, cartilaginous projection colorless; fins colorless; eye light silvery blue.

### Family TETRAGONURIDAE

#### *Tetragonurus atlanticus* Lowe

Haul 20; 1 specimen, 66 (52.9) mm. Depth of haul 400-450 meters.



*Color*.—Fresh specimen dark gray with greenish-blue reflections on cheeks and sides.

#### Family MELANOCETIDAE

##### **Melanocetus murrayi** Günther

Hauls 27, 41; 2 specimens, a female 49 (40) mm. and a larval female about 5 (3.5) mm. Depth of hauls 1280–1370 (adult) and 500–550 meters (larva).

*Color*.—Larger specimen, freshly preserved, brownish above, abdomen and tail blackish brown; illicium stem pale, esca dark brown with whitish tip.

#### Family ONEIRODIDAE

##### **Lophodolus acanthognathus** Regan

Haul 51; 1 specimen, 14 (9.5) mm. Depth of haul 730–820 meters.

#### Family CERATIIDAE

##### **Cryptopsaras couesi** Gill

Hauls 16, 30, 38, 45, 58, 59; 6 specimens: 3 females 28 (21.5) to 57 (45) mm. and 3 larval or metamorphosing males 6.5 (4.5) to 9 (6.5) mm.

*Remarks*.—The metamorphosed specimens were caught between 500 and 2000? meters, the young in about 275 and 1000–1460 meters.

The stomach of the specimen from Haul 45, length 29 (23) mm., contained five whole ostracods, the posterior end of a large copepod and remains of red crustaceans.

##### **Edriolychnus schmidtii** Regan

Haul 63; 1 specimen, 35 (25.5) mm. Depth of haul 1280–1370 meters.

*Color*.—Fresh specimen opaque white inside the transparent outer skin, peritoneum jet black; black pigment forming on caudal peduncle; iris blue; pupil black; a few minute, scattered black dots dorsally on outer skin; esca black except on top where a white area extends downward posteriorly in a narrow band.

*Remarks.*—This is a young fish with a sessile illicium, of which only the esca protrudes through the skin. It was alive when captured.

**Linophryne bicornis** Parr. Figure 56.

Haul 24; 1 specimen, 42 (28.5) mm. Depth of haul 1000–1100 meters.

*Description.*—Teeth loose, easily lost; a pair on vomer; upper jaw with a pair of long fangs anteriorly, a smaller pair somewhat behind these, and five shorter teeth on each side; lower jaw with an anterior pair of fangs followed by a longer pair (an extra fang on left side) and four smaller teeth on each side. Globular esca outwardly transparent except at base, where there is some black pigment; inner core black with a yellowish-white distal area; lateral filaments white, constricted a short way from tips;<sup>1</sup> illicium stem black. Barbel stem black except at distal end; nodules and filaments at tip all white.

Measurements in millimeters, followed in parentheses by measurements expressed in hundredths of standard length, first for CNHM no. 49638, secondly for the type, also from Bermuda, the latter measurements based on those reported by Parr (1927, Bull. Bingham Oceanogr. Coll., 3, Art. 1, p. 9, fig. 2): length of lower jaw 14.5 (51.0, 40.7), snout to base of preopercular spine 15 (52.6, 48.2), diameter of eye 3 (10.5, 9.25), length of preopercular spine 2.5 (8.77, 11.1), length of sphenotic spine 3 (10.5, —), illicium stem 5 (17.5, 14.8), height of esca 4 (14.0, —), width of esca 4 (14.0, —), lateral filaments 4.5 and 5 (15.8 and 17.5, —), length of barbel 20 (70.3, —), barbel stem 9 (31.6, —).

*Remarks.*—This is the second known specimen of the species. It was taken from the net in perfect condition but became flattened and somewhat distorted in shape during shipment.

**Linophryne arborifera** Regan

Haul 60; 1 specimen, 40.5 (27) mm. Depth of haul 500–550 meters.

*Color.*—Fresh, body jet black; fins, cephalic spines, and teeth white; near tip of each outer caudal ray a short oblong patch of tissue (luminous?), similar streaks on dorsal and anal fins; basal part of esca black, distal area yellowish with a pearly white organ

<sup>1</sup> Jointed ends probably broken off in type.



FIG. 56. *Linophryne bicornis* Parr. Haul 24. a, esca, front view; b, end of barbel.

superimposed upon it. The specimen was brought to the surface alive, at which time the esca glowed with a steady white light when the fish was handled, the light disappearing when the fish was returned to water.









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